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78. A magnetic head, comprising:

a lower magnetic shield layer;

a magnetoresistance effect device formed on said lower magnetic shield layer through a lower reproduction magnetic gap, said magnetoresistance effect device being as set forth in claim 70; and

an upper magnetic shield layer formed on said magnetoresistance effect device through an upper reproduction magnetic gap.

IN THE DRAWINGS:

Subject to the approval of the Examiner, please add the label -PRIOR ART-- to Figs. 36 and 37, and add the labels --PROBABILITY OF OCCURRENCE OF BHN (%)-- and --RESIDUAL MAGNETIZATION Mr (emu/cc)-- to Fig. 32 as shown in red in the attached Request for Approval of Drawing Change.

REMARKS

The Examiner in the Office Action objected to Figs. 36 and 37 for failure to label as "Prior Art"; objected to the title of the invention, objected to the disclosure; objected to claim 47 under 37 C.F.R. § 1.75(c) as being of improper dependent form; and rejected claims 21-23, 26, 47, and 48 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,018,037 to Krounbi et al. ("Krounbi") in view of 5,733,370 to Chen et al. ("Chen").

Applicants have provided a new title, corrected informalities in the specification, and corrected the dependency of claim 47. Applicants have also submitted new claims 59-78 directed to Species VII provisionally elected September 28, 1998.

LAW OFFICES
FINNEGAN, HENDERSON, FARABOW, GARRETT, & DUNNER, L.L.P.
1300 I STREET, N.W.
WASHINGTON, D.C. 20005
202-408-4000

The object of the present invention is to provide a magnetoresistance effect device having a hard magnetic film with excellent magnetic characteristics such as coercive force Hc, saturation magnetization Ms, residual magnetization Mr, and square ratio S, so as to provide the sufficient bias magnetic field to the Mr film without increasing the film thickness of the hard magnetic film, thereby effectively suppressing the Barkhausen noise.

Regarding the §103 rejection of claim 21 as being unpatentable over Krounbi in view of Chen, Applicants respectfully traverse this rejection. Claim 21 is directed to a magnetoresistance effect device comprising a combination of elements including a substrate having a main surface, a magnetoresistance effect film formed on the main surface of the substrate and having a magnetic field detecting portion, and a pair of bias magnetic field applying films disposed adjacent to both edge portions of the magnetic field detecting portion, the bias magnetic field applying films having hard magnetic films containing Co as a structural element and having a bi-crystal structure.

Krounbi discloses a magnetoresistance read transducer comprising a substrate 21; an MR trilayer structure 27 comprising an MR layer 22, a soft magnetic film 23, and a non-magnetic spacer layer 25; and a hard magnetic bias layer 26 in each end region. Krounbi discloses the hard magnetic bias layer 26 as "provided with a single layer of metallurgy such as CoCr, CoPt or CoCrPt, for example, although the use of under- and/or overcoats such as W or Au may be desirable." The Examiner admits, however, that Krounbi "is silent as to bias magnetic field applying films having hard magnetic films containing cobalt (Co) as a structural element being a bi-crystal structure" (page 5 of the Office Action).

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT,
& DUNNER, L.L.P.
1300 I STREET, N.W.
WASHINGTON, D.C. 20005
202-408-4000

Chen discloses a method of manufacturing a bicrystal cluster *magnetic recording medium*. The magnetic recording medium of Chen comprises a glass ceramic substrate 30, a seed layer 31, a chromium underlayer 32 having a (200) crystallographic orientation, a magnetic cobalt alloy layer, a carbon overcoat and a lubricant. The Examiner cites Chen as teaching at "column 3, lines 37-50 magnetic field applying films having hard magnetic films containing cobalt (Co) as a structural element being a bi-crystal structure."

There is no teaching or suggestion in Chen that the disclosed magnetic layer can be used in a magnetoresistance recording/reproduction head as a bias applying film. The magnetic layer is not used for applying a longitudinal bias to magnetoresistance effect film as disclosed in Krounbi. There is simply no teaching or suggestion that the disclosed film of Chen could be used in the transducer of Krounbi. The magnetic recording medium of Chen is from a distinct field of invention posing distinct problems from those posed by the transducer of Krounbi. A person of ordinary skill in the art, therefore, would not have been motivated to use a structural element of the medium of Chen in the transducer of Krounbi.

Further, the Examiner cites as the motivation for combining the references that "one of ordinary skill in the art at the time the invention was made would have been motivated to . . . suppress Barkhausen noise in the magnetic head." Initially, Applicants note that Chen fails to mention Barkhausen noise. It is clear, therefore, that the Examiner impermissibly derived the cited motivation from Applicants' disclosure rather than from the cited reference. The noise described by Chen, as cited by the Examiner, is noise in the recording medium (i.e., "medium noise" column 1, lines 24-32 of Chen).

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT,
& DUNNER, L.L.P.
1300 I STREET, N.W.
WASHINGTON, D.C. 20005
202-408-4000

In the magnetic recording medium of Chen, information is recorded by a number of bits that have different magnetization directions. The medium noise relates to a transferring state of magnetization directions that are recorded *on the hard magnetic film itself*. The state of the transferring regions become sharp due to the use of a bi-crystal structure in the medium.

In contrast, Barkhausen noise, as disclosed by Applicants, is caused by the shifting of magnetic domains when the magnetic domains are formed in a free layer of the MR film (page 2, lines 6-14 of Applicants specification). The hard magnetic bias films in the magnetic head are used to suppress the formation of magnetic domains in the free layer and to form a single domain *in the MR film*. The Barkhausen noise in Applicants' MR film poses a distinct problem from the medium noise in the hard magnetic film of Chen. A person having ordinary skill in the art, therefore, would not have been motivated to use the film of Chen in the transducer of Kroubi in order to suppress Barkhausen noise as suggested by the Examiner.

Finally, as pointed out by Applicants at page 28, lines 15-20, of the specification, the magnetic properties desired from use of a hard magnetic film as a bias film are not the same as those desired from a magnetic film in a recording medium. The value of the residual magnetization times the thickness of a hard magnetic film for use in a recording medium is preferably low in order to decrease noise in the medium. This property would not be desired for use as a bias film, and therefore, it would not have been obvious to a person having ordinary skill in the art that the film of Chen should be used in the transducer of Krounbi.

For the above reasons, Applicants assert that claim 21 is patentable over the

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT,
& DUNNER, L.L.P.
1300 I STREET, N.W.
WASHINGTON, D.C. 20005
202-408-4000

applied references. Regarding claims 22, 23 and 26 as filed and new claims 59-61, these claims are patentable at least in view of their dependency from claim 21. Further, claims 47 and 48, which include all of the limitations of the claim 21 device are also patentable for the same reasons as applied to claim 21 above.

Regarding new claims 62-78, each of these claims is directed to aspects of the Group VII species that are not taught or suggested by the cited references. These claims, therefore, are also patentable over the applied references.

In view of the foregoing amendments and remarks, Applicant respectfully requests the reconsideration and reexamination of this application and the timely allowance of the pending claims.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

By: Walter J. Sutcliff Reg. No. 24,914
for Richard V. Burgujian
Reg. No. 31,744

Date: 4/7/99

LAW OFFICES
FINNEGAN, HENDERSON,
FARABOW, GARRETT,
& DUNNER, L.L.P.
1300 I STREET, N. W.
WASHINGTON, D. C. 20005
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